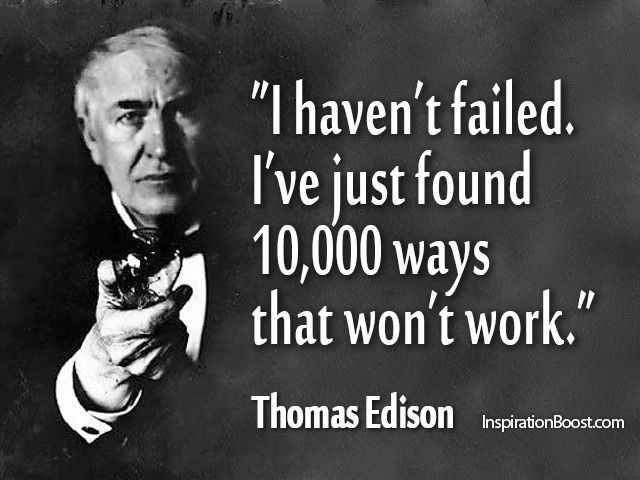
**Student Page**

**Grade Level: 6th Grade**

**Standards**: Forces In Nature  
**GLE 0607.12.2** Explain how simple electrical circuits can be used to determine which materials conduct electricity.   
**0607.12.2** Determine a material’s electrical conductivity by testing it with a simple battery/bulb circuit.   
**SPI 0607.12.2** Identify materials that can conduct electricity.   
**0607.12.3** Compare and contrast the characteristics of objects and materials that conduct electricity with those that are electrical insulators.   
**SPI 0607.12.2** Identify materials that can conduct electricity.

**Task Objective:**

The learner will test different materials using a simple electrical circuit to determine its conductivity.

The learner will be able to identify materials that can conduct electricity and compare them with materials that are insulators.

**Materials Needed:**

1 – Small Circuit Board (Already prepared for this activity)

1 – AA Battery Holder

1 – Mini Lamp and Base Assembly

2 – Alligator Clips

1 – AA Battery

Optional – A cardboard or wooden base for mounting materials

Objects to test for conductivity

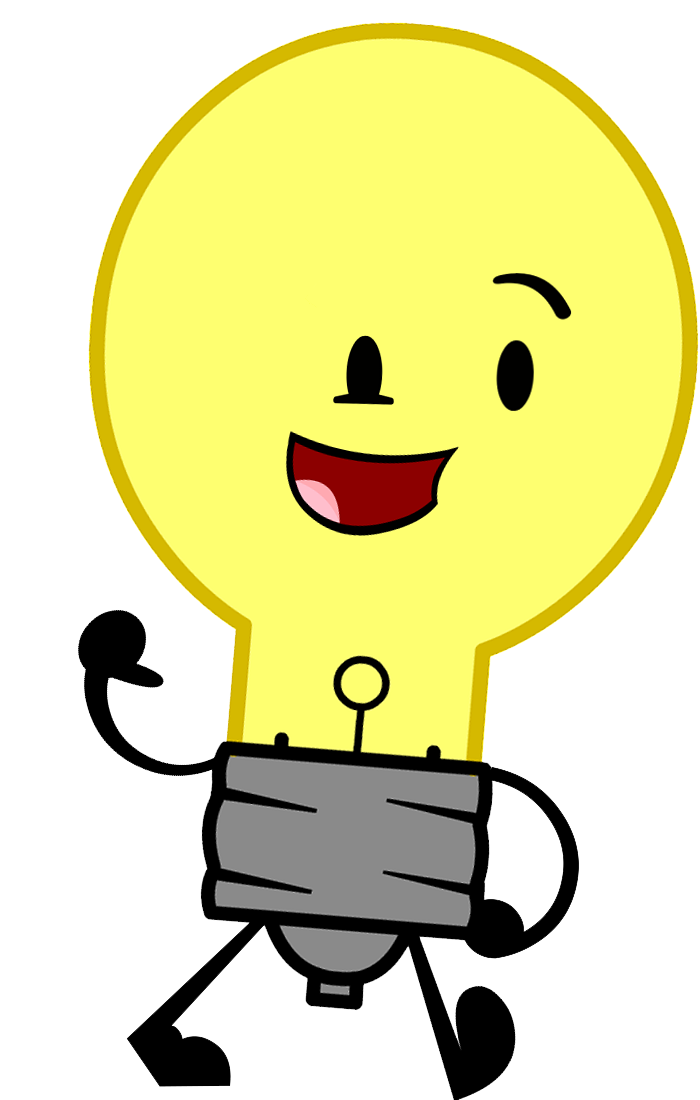
Conductors and Insulators Worksheet

Interactive Notebook

Pencil

2 Cups

**Student Instructions (with prepared small circuit board): Very well written and easy to follow.**

1. Carefully remove a circuit board and two clear cups from the box.
2. Unclip the bag of objects and take one worksheet from the back of the circuit board.
3. Place one cup in each of the rings at the top of the circuit board.
4. On your worksheet, predict whether you think each object listed will be a conductor of electricity or an insulator by checking the box beside the word.
5. Test each object for conductivity by clamping each alligator clip onto the object. If the light bulb lights up, electrons were able to freely move through the object and complete the circuit, producing electricity. If the light bulb does not light up, the object did not allow the free flow of electrons to complete the circuit.
6. After testing an object and determining whether it is a conductor or an insulator, place it in the appropriate cup on the board.
7. Record the findings on your worksheet as you go. In the table, list the tested object and label it as a conductor or an insulator.
8. Cut and paste the worksheet to fit in your Interactive Notebook.
9. Look at each cup of objects. Notice similarities and differences between the items in each cup. Also, compare the objects in the two cups with each other. Notice similarities and differences between the ~~two cups~~ items.
10. On the next page of your Interactive Notebook, compare and contrast the differences and similarities of the items you tested during your experiment by using a Venn diagram.

**Academic Vocabulary:**

conductors, insulators, electricity, electrons, current, circuit (What activity are they doing to specifically practice using vocabulary? See explanation on the student page template. Suggestion: you can ask the students to use the terms in their summary for the “A Picture Tells a Thousand Words”)

**Assessment:**

A Picture Tells a Thousand Words (FACT #42)

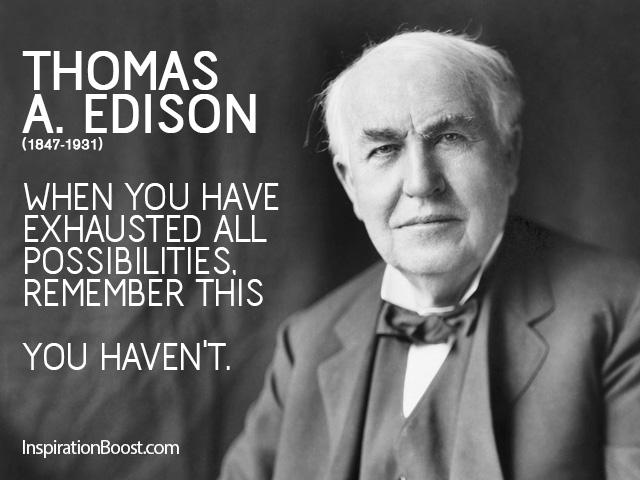
You will be photographed during the investigation activity. You will be given a copy of your picture and will write a summary about what you are doing and learning at the moment the picture was taken.

**Clean-up:**

Place all loose objects into the Ziploc bag and close the bag. Use the clip to clip the bag back onto the circuit boards. Carefully place the board back into the box and close. When handling the circuit boards, use caution and be sure to not damage the board, light fixture, battery compartment or testable objects.

**Teacher Page**

**Grade Level: 6th Grade**

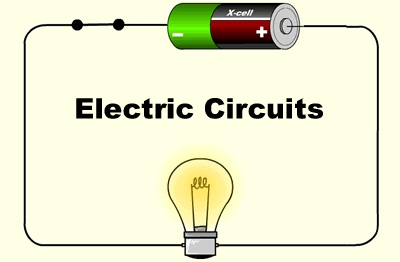
**Standards**: Forces In Nature  
**GLE 0607.12.2** Explain how simple electrical circuits can be used to determine which materials conduct electricity.   
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**0607.12.3** Compare and contrast the characteristics of objects and materials that conduct electricity with those that are electrical insulators.   
**SPI 0607.12.2** Identify materials that can conduct electricity.

**Task Objective:**

The learner will test different materials using a simple electrical circuit to determine its conductivity.

The learner will be able to identify materials that can conduct electricity and compare them with materials that are insulators.

**Explanation: Well stated.**

When electrons move, they carry electrical energy from one place to another. This is called an electric current. Electric currents power the appliances we use everyday. Some materials allow the flow of electrons through them, making them good conductors of electricity. Some do not and are referred to as insulators. [Metals](http://www.explainthatstuff.com/introduction-to-metals.html) like copper have "free" electrons that are not bound tightly to their parent atoms. These electrons flow freely throughout the structure of copper and this is what enables an electric current to flow. In rubber, the electrons are more tightly bound. There are no "free" electrons and, as a result, electricity does not really flow through rubber at all.

In order for a current to happen, there must be a closed path—or a closed loop around which the electric current flows. With the small circuits used in this activity, the loop is not closed until the two alligator clips are attached to something or each other. If they are attached to a conductor, the current, or flow of electrons, completes the circuit and allows the electrical energy to light the bulb. If the object is an insulator, the electrical energy cannot flow through and reach the bulb.

**Academic Vocabulary:**

Conductors – A material which heat and electricity flows easily through

Insulators – A material that does not allow the free flow of heat or electricity

Electricity – The flow of electrons around a circuit

Electron – Something that is in the atom moving away from the nucleus  
Current – the steady flow of electrons

Circuit – A closed path in which electric charges flow

The chosen vocabulary words are necessary in explaining simple electric circuits and the idea of conductivity. An understanding of the words and their definitions is essential if the learner is to understand the concept behind this lesson. Need to include a description here of the specific activity (see explanation on the student page template) you selected to use for academic vocabulary and rationale for the activity…

**Common Misconceptions:**  
A common misconception relating to simple electrical circuits is that batteries have electricity inside them. Need to elaborate on misconceptions – there are a good number of other things that you can include referring to insulators and conductors as well.

**Real World Connection:**

****By seeing how the simple electrical circuit allows the flow of electrical energy from one place to another, they can begin to understand how everyday items work. A flashlight, for example, has a simple circuit inside it consisting of a switch, a battery and a lamp. This could ignite curiosity as to how other things in their every day surroundings work.

By seeing how the flow of electricity happens on a small scale, the student can begin to ask questions and analyze how larger projects are completed. The wiring in houses, for instance, follows the same basic principles of the small electrical circuits. This is quite true regarding circuits; however, you need to go beyond electrical circuits to address the main concepts of your activity – insulators and conductors.

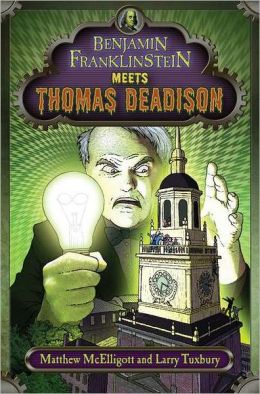
**Connections Across the Curriculum:  
Very appropriate connections.**

**Visual Art**

The student will use a digital camera to photograph objects they see in their everyday life that demonstrate~~s~~ electrical flow. Students will use their pictures to create a photo collage art piece.

Standard 1.0 Media, Techniques and Processes  
Students will understand and apply media, techniques, and processes.  
CU 1.2  Use media and tools safely and appropriately (i.e., show correct manipulation of materials and tools).

**English Language Arts**

The student will read Benjamin Franklinstein Meets Thomas Deadison by [Matthew McElligott](http://www.barnesandnoble.com/c/matthew-mcelligott/2723830), [Larry David Tuxbury](http://www.barnesandnoble.com/c/larry-david-tuxbury) and write a five-paragraph essay describing how the story’s plot unfolds.

Literature, 3. Describe how a particular story’s or drama’s plot unfolds in a series of episodes as well as how the characters respond or change as the plot moves toward a resolution.

**Mathematics**

The student will analyze their data to determine the percentage of conductors in the test bag and the percentage of the insulators in the test bag. They will also calculate the percentage of their predictions; what percentage was predicted to be conductors and what percentage was predicted to be insulators? Compare the predicted amounts to the actual amounts. Excellent choice – ratios in particular are a big part of 6th grade math so very appropriate to practice with this activity.

Ratios and Proportional Relationships: Understand ratio concepts and use ratio reasoning to solve problems.  
3. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.   
c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.

**References: Very good - specific explanation of what each source was used for and a direct link.**

Inspiration for the Conductor/Insulator Worksheet

<https://docs.google.com/file/d/0B-QwI_A-sPclNWYyMGQxZjYtYjFlYS00NDNkLTg1ODktYmQ2ZTUwMmY3MmIy/edit?hl=en&authkey=CKyT750B>

Explanation of How Currents and Electricity Works

<http://www.explainthatstuff.com/electricity.html>

Academic Vocabulary

<http://quizlet.com/14073096/6th-grade-science-electricity-flash-cards/>

Activity – Testing for Conductivity

<http://sciencelearn.org.nz/Contexts/Super-Sense/Teaching-and-Learning-Approaches/Testing-for-conductivity>

Benjamin Franklinstein Meets Thomas Deadison

<http://www.barnesandnoble.com/w/benjamin-franklinstein-meets-thomas-deadison-matthew-mcelligott/1108487434?ean=9780399254819>

Clipart and images

<http://www.google.com/imghp>

Conductors & Insulators

What is a conductor?

It is a material that heat and electricity flow easily through.

What is an insulator?

It is a material that heat and electricity do not flow easily through.

Hypothesis:  
Put a check beside the objects that you think will be a good conductor:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Penny |  | Pom Pom |  | Bobby Pin |
|  | Q-Tip |  | Wire |  | Quarter |
|  | Bouncy Ball |  | Bottle Lid |  | Aluminum Foil |
|  | Key |  | Paper Money |  | Rubber Band |
|  | Straw |  | Yarn |  | Glass Rock |

Experiment:

Test each object using the circuit. To test, hold the alligator clips so that they touch the object. Look to see if the bulb lights up. If it does, it is a conductor. If it does not, it is an insulator.

Record:

|  |  |
| --- | --- |
| Object | Insulator or Conductor? |
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